

AIR WAR COLLEGE

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INFORMATION-BASED WARFARE:
A THIRD WAVE PERSPECTIVE

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A RESEARCH REPORT SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE CURRICULUM

REQUIREMENT

Advisor: Lt Col James Brungess

MAXWELL AIR FORCE BASE, ALABAMA

May 1995

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ABSTRACT

TITLE: Information-based Warfare: A Third Wave Perspective

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The information revolution provided the technology to process vast amounts of data and make it accessible instantaneously and simultaneously to anyone anywhere in the world. This capability has impacted the world economy in particular. Nations have moved from a domestic to a global focus and nations have become more interdependent. The Tofflers' proposed a model which depicts a trisected world with societies categorized by how they make wealth. The most advanced wave, the Third Wave, creates wealth through knowledge. Consistent with the Tofflers' model, economies of Third Wave societies are becoming more and more dependent upon knowledge. Increased economic competition among the wealthy nations, and increased disparity between the haves and have-nots have intensified economic conflict as nations attempt to ensure prosperity. The effects of the information revolution on the global economy have made the wealthy nations more vulnerable to information-based warfare against the economic instruments. If the Tofflers' model accurately depicts the wealth generation methods of the Third-Wave, then the most likely future war-form is information-based warfare against the economic instruments. Third Wave societies are ill-prepared to defend against this new war-form. The advanced nations must recognize their vulnerabilities and develop the policies and means to protect themselves against these new threats.

BIOGRAPHICAL SKETCH

Lieutenant Colonel David M. Komar (B.S. in Physics, John Carroll University and M.S. in Systems Management, Air Force Institute of Technology) has been involved in the Command, Control, Communications and Computers career field since entering the United States Air Force in 1970. He enlisted in the Air Force following graduation from John Carroll University. After three years as an enlisted Special Electronics Technician, Lt Col Komar was commissioned in 1974 through OTS. Following graduation as a distinguished graduate from the Electronics Systems Officer School, he was assigned as Maintenance Supervisor at a SAC Radar Bomb Scoring Detachment at LaJunta, Colorado. Lt Col Komar has had four unit assignments overseas, including American Samoa, Australia, Japan and Guam. Headquarters staff assignments include Air Staff, Tactical Air Command, the Air Force Technical Applications Center, and 13th Air Force. Command experience includes Deputy Commander and Commander, 4th Combat Communications Group in Japan and Guam from 1987 until 1992. Lt Col Komar has also attended Air Command and Staff College in-residence.

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Introduction

Historically, the world is at a critical crossroads. Significant changes have occurred along parallel paths in several very different areas. The bipolar world of the two great superpowers has dissolved into a quagmire of regional and Third World conflicts. The "clash of civilizations" predicted by Samuel P. Huntington is resurfacing age old tensions based on religious and ethnic differences. The unequal distribution of wealth between the world's haves and have-nots surfaces in hunger, poverty, greed and envy among the world's population and between nation-states. The world has become so economically and politically interdependent that governments have relinquished control to multinational corporations and individuals in the name of prosperity.

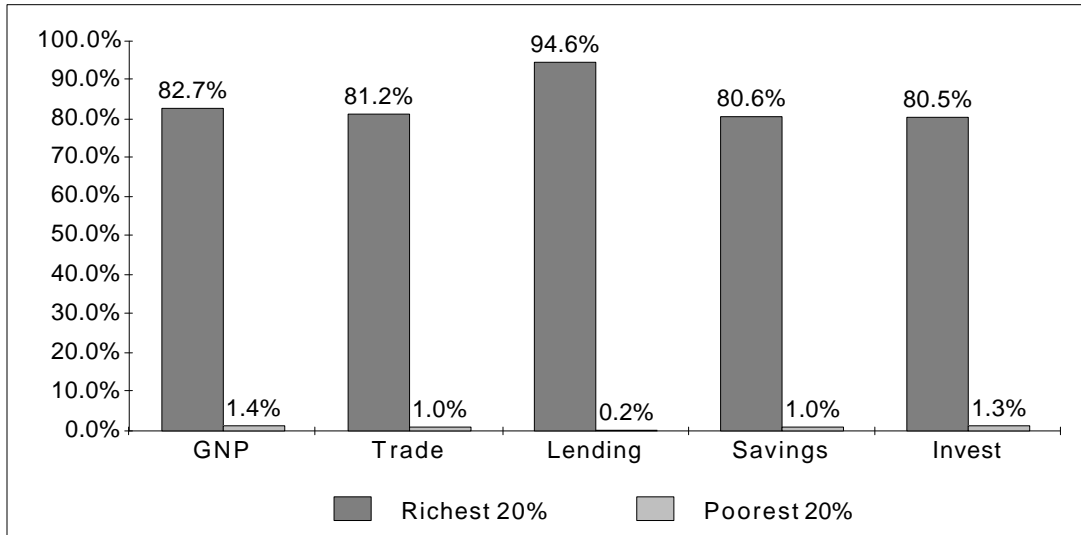
Much of this current environment has been a result of the capabilities provided by the information revolution. It has been a quiet revolution with effects that have eased into our lives with none of the fanfare of the earlier industrial revolution. The associated technology of the information revolution has evolved at an exponential rate and has become embedded in literally every day to day function. The greatest impact however, has nothing to do with the technology, but with the information represented by the bytes and bauds that pass through the electronic superhighways. For the most part this information is unseen and untouchable. It belongs to everyone, yet no one. One instant it can have infinite value, and in the next it may become worthless.

This new revolution has also brought about a greater economic interdependence among the nation states of the world, especially among the core group of advanced states -- the United States, the European Economic Community (EEC), and Japan. Trade as a percentage of world product has increased dramatically since 1960, accounting for \$3 trillion out of a \$22 trillion global GNP in 1990. Foreign investment has grown even faster, outpacing world trade by a factor of three since 1975. There are now about 5,000 transnational organizations such as World Bank and Exxon -- double the number since 1945.¹ The computer and global communications systems have made it easier to achieve this interdependence which is critical to economic survival. New and less layered organizational structures have resulted in the transfer of information outside

the control of traditional hierarchical organizations. The information revolution and subsequent economic interdependence have combined to redefine national sovereignty. To compete in this environment nations have had to relinquish control of critical financial and economic information. "As equally dangerous international economic competition supplants megaton military intimidation, offensive pugnacity will be aimed at the informational and financial infrastructure upon which our Western economy depends." ² In this new arena the world is constantly at war.

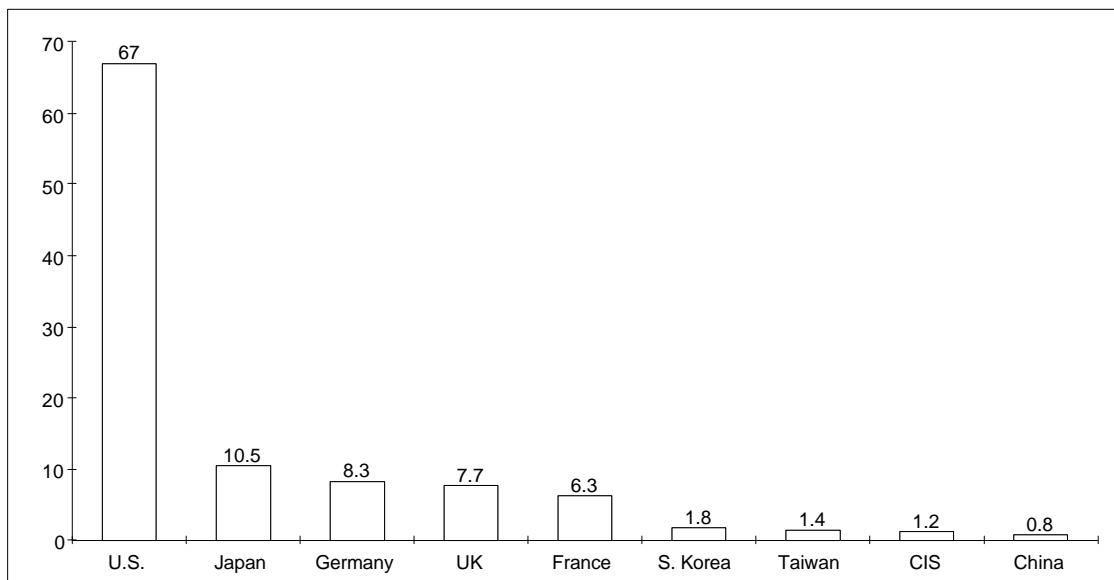
The Tofflers' have proposed a model that depicts a trisected world with societies categorized by how they make wealth. The most advanced wave, the Third Wave, creates wealth through knowledge. This new "civilization" is characterized by information as a critical element for both power and wealth. Its primary tool is the computer and the communications systems that globally disseminate information. The computer has also become the implement of a new war-form focusing on information. While information-based warfare has been viewed typically from the perspective of military power, a nation's power derives not only from its military power, but from the economic dimension as well. Information-based warfare has significant implications in this dimension.

This paper discusses information-based warfare in the context of the Tofflers' Third Wave and attempts to show that the most likely new war-form will be economically based. The new "peaceful" world has resulted in an environment in which economic power dominates. Consistent with the Tofflers' model, economies of Third Wave societies are becoming increasingly dependent upon knowledge as a source of wealth. Increased economic competition among the wealthy nations, and the increased disparity between the haves and have-nots of the world (see Table 1), have intensified economic conflict as nations struggle to ensure prosperity for their people. The effects of the information revolution on the global economy have made the wealthy nations more vulnerable to information-based attacks against the economic instruments that are increasingly dependent upon information technology (see Table 2).



Source: United Nations, 1992

Table 1: World Economic Distribution



Source: 6th Annual Computer Industry Almanac, 1993

Table 2: Computers by Country (Millions)

The approach used begins with a discussion of the impacts that information technology had on the global economy. The concept of war-form from the Tofflers' Third Wave perspective is reviewed to show the relationship between wealth generation and war-form. The conclusion drawn is that the Tofflers' definition is too narrowly focused on the military dimension only. In light of this, the concept of information-based economic warfare is discussed both as a concept and then as a possibility. This war-form was used during the cold war, is occurring today, and is likely to continue in the future. Third Wave nations must be prepared to deal with this new threat while at the same time ensuring full use of the capabilities developed during the information revolution.

This is a rather complex subject, involving new concepts in a rapidly and significantly changing world. As a result, it is not well understood and therefore not readily accepted, especially among a military community that is focusing its attention on finding better ways of placing "bombs on target". In the context of this paper, information-based warfare is broader than just the military dimension. It is far more than Command and Control Warfare. Generally, the target sets involved in information-based economic warfare would not be considered military, and neither are the "warriors" in this deadly game. "Information warfare is an electronic conflict in which information is a strategic asset worthy of conquest or destruction. Computers and other communications and information systems become first-strike targets" as well as the weapons.³ This new battlefield is as threatening as any encountered in military warfare, and the consequences of defeat are potentially more dire than from any military confrontation. The nations of the world have become intertwined as a result of the international dependencies associated with the global economy. The information revolution has created an environment that is redefining national sovereignty. Therefore, conflict is therefore as likely between nations and non-government organizations as between two nation-states.

The Information Revolution and the Global Economy

The information revolution has been characterized as one of the most significant events in the history of humankind. It began with the introduction of the first computer in 1946 and,

mostly as a result of the very implement of its power (the computer), its growth has been rapid and its impacts far reaching. The more powerful computers become, the better able they are to help in the development of even more powerful data processing capabilities. Since its introduction, the efficiency of the computer has grown a millionfold and personal computers have become readily available. For the moment, there are no limits to its growth potential.

"Technology being developed in laboratories today suggests that by the year 2007, single processors will approach the raw computing capability of the human brain. The rate of change is such that each new generation of processors becomes obsolete after about a year and a half. ⁴

Perhaps the most significant change as a result of the information revolution, is the global availability of information. Global communications systems are already in place and growing rapidly in number and capability. Corporations are working on multiple satellite constellations that within five years will allow communications from any spot on earth to any other place. These satellite networks are being interfaced to fiber-optical land lines that will allow extraordinary user-selection and transmission capacity. Entire countries are being wired. Third world countries, such as Turkey, are beginning projects that will effectively move their country from near medieval conditions into the information age. Integrated global networks will carry video, data and voice across national boundaries, transferring the globe into a local network overcoming time and distance, transforming the concepts of communications, business, and ways of life. ⁵ The information revolution has with the launch of a satellite eliminated the boundaries imposed by national borders. This observation goes well beyond the implications of spy satellites transiting national aerospace. The information revolution has dramatically reduced if not virtually eliminated the ability of a government to control, focus, or eliminate information directed at the population. The presence of information technology has become so powerful that those who accept it will also have to accept dramatic social changes. Those states that reject it risk the possibility of destruction. ⁶

Supporting this vision are factors that are emerging today, including the move toward a global economy that will create the demand for such services. The United States has undertaken

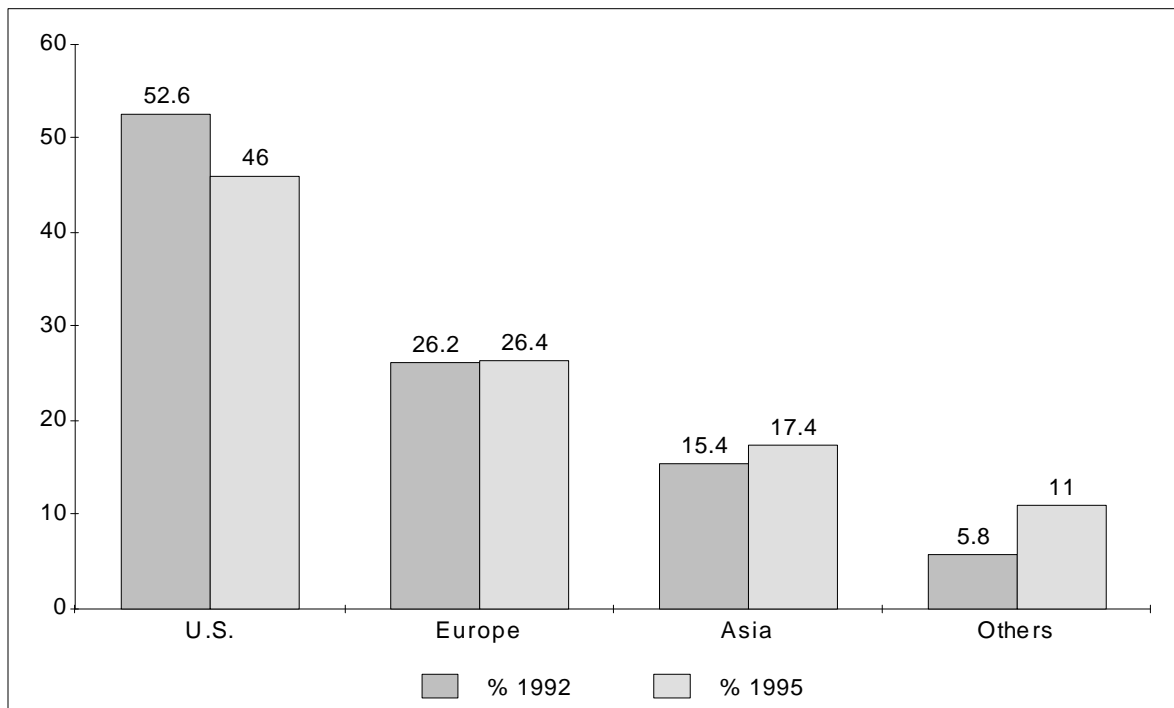
the establishment of a National Information Infrastructure which is forecast to increase U.S. productivity growth by 0.4% and create more than \$300 billion in national wealth over the next 16 years.⁷ Interdependence of national economies is a fact of life. Rapidly expanding and generally non-discriminatory trade, large scale and rapid movements of funds from one political center to another and the rapid growth of huge multinational enterprises led to a high degree of economic interdependence among Western powers. These changes have been accelerated and nations have become further integrated by further advances in information technology. This interdependence and trade relationships have made national and international financial institutions critical to the operation of national economies.⁸

While computers and their associated communications systems have become powerful economic forces, they have done more than just speed up processing or make life more convenient. The information revolution has created a new wealth based on the application of knowledge to work. In a world in which the most precious resource is immaterial, the economic models and organizational structures are also changing. In the past, an abundance of natural resources once secured competitive advantage. Conversely, limited resources have forced corporations to achieve greater efficiencies. For example, technical progress in the development of stronger and lighter materials is quickly replacing raw materials. In today's global environment, knowledge, not abundance of natural resources, is the key to wealth. The economic power attached to information will impact financial institutions and government policy.⁹

For these reasons, the information revolution has changed the very power structure of the wealth generation system. "As information proliferates at faster speeds and is available to a wider array of individuals, hierarchical organizations evolve into networks and power is shifted more to individuals and groups." The concept of order appears to resemble chaos. Internettted data bases allow skillful networkers to gain access to broad ranges of information in nanoseconds.¹⁰ Layers of management that did nothing but relay information from one level to another are disappearing, as business learns that technology allows the rapid transmission of vital information to all levels of management without human intervention.¹¹ The dissemination of once closely

held information to large numbers of people who didn't have it previously changes power structures. When a system of national economies linked by government-regulated trade is replaced by an increasingly integrated global economy, beyond the reach of much national regulation, power by necessity changes hands.¹² The power inherent in the economy transfers from the government to those who control what passes through the electronic superhighways.

While it is true that the fruits of the information revolution are more readily available in the technologically advanced nations, these capabilities are becoming increasingly available as well to the Third World and developing countries of the world (see Table 3). In a sense,



Source: Electronics Magazine, July 1994

Table 3: Percentage Growth of Computers

information technology is an equalizer among nations both in peace and in war. "Technology knows no boundaries, and its diffusion is worldwide. The United States no longer dominates all emerging technologies. Most components and many capable systems are available for

international sale. Military and economic competitors can be expected to have capable and sophisticated weapons in any future operation." ¹³ Most functions relating to the international economy can be performed from the home or office using commercially available personal computer terminals netted to required data bases.

Economically, the world is becoming both much more intertwined and at the same time more divided -- intertwined in terms of trade, divided in terms of wealth distribution. In years past, nations controlled what nations they traded with, the interest rates and tariffs they charged, and the information they released. The integration resulting from the information revolution has resulted in restrictions in the ability of nation states to exercise these and other traditional instruments of national sovereignty, including the use of military power. These characteristics have created vulnerabilities that can be exploited by a new war-form. Nonmaterial and extremely mobile, information can escape government or corporation control far more easily than other forms of capital. This new war-form will be used to exploit, disrupt or destroy information such that one state or corporation or individual possesses a superior understanding of a potential adversary's political, economic, military, or social/cultural strengths, vulnerabilities, and interdependencies. ¹⁴

The Third Wave War-form

The Toffler's have postulated that "the way we make war reflects the way we make wealth - and the way we make anti-war must reflect the way we make war." ¹⁵ Their theory categorizes the world into three civilizations or "waves" of change. The First Wave is an agrarian society; the Second Wave is the industrial, and the Third Wave is informational. Each of these three civilizations resulted from the transformation to different forms of wealth generation. The initial "First Wave" being agrarian fought primarily over land. The industrial revolution bisected the world into a dominant "Second Wave" which fought wars over physical productive capacity. The Third Wave, which is symbolized by the computer, is evolving and will fight future wars over the access and control of knowledge. ¹⁶ The Tofflers contend that warfare follows wealth. "In other words, the culture, technology, communications, technical skill, and organizational patterns that

develop in a society and define its economy, also describe the constellation of patterns which result in the way society makes war.¹⁷ Consistent with the Tofflers' model, future wars for Third Wave civilizations will take the form of information-based warfare, with information as the primary center of gravity and the products of the information revolution as the tools/weapons.

The societal and economic changes we see in the way we produce and service things are reflected in military forces employing smart weapons with increased lethality and reduced casualties and collateral damage. Information-based warfare relies on sophisticated communications, imbedded intelligence, access to space, and real-time decision loops.¹⁸ However, this representation of the new war-form is misleading. In reality it is merely a new way of implementing the old. It is information age warfare, not information-based warfare. Today, automobiles are produced better and faster because of the technology that has developed from the information revolution, but we are still building cars with rubber tires and internal combustion engines. The same technology that automated the automobile industry has provided the capability to execute "cleaner" and "lower casualty" wars than ever before. This technology enables the Third-Wave nation to *sometimes* conduct efficient wars with First and Second-Wave adversaries. However, even in these scenarios we have not learned how to apply it effectively, as in the cases of Bosnia, Somalia and Haiti. Nor does this characterization of the new war-form provide the means for successfully confronting another Third-Wave society.

While the Tofflers have expounded on the origins of this new war-form, the objectives, potential adversaries, and methods are too narrowly focused for the society that holds in high esteem the continued prosperity of its people. The Tofflers recognized the embryonic state of the Third Wave war-form. "For the evolution of the Third Wave war-form will not be complete until its primary resource is understood and deployed. The final development of Third Wave war may well be the conscious design of something the world has not yet seen: competitive knowledge strategies."¹⁹ In the broadest sense, a knowledge strategy will incorporate all of the means by which information is acquired, from research and development, to intelligence, to the direction of the world's brain drain flow. The competition for the best information is vastly different from the

competition for the best bottomlands or the best coalfields. Companies or nations competing for information will be vastly different from those that once competed primarily for material resources. The nature of information will impact government policy, set the limits of government power, and redefine sovereignty.²⁰ The continuing enhancement and defense of the nation's knowledge assets are preconditions for the survival of the Third Wave societies. The Tofflers foresee a progression of military thinking which goes beyond the more general notion of "information-based warfare and includes not only military but also economic, diplomatic and even ecological components."²¹

War has been defined as the systematic and extensive use of violence as a means of policy by an organized social group claiming (but not necessarily exercising) legitimate control over a given territory, against another such group. What we call economic, political, and ideological warfare are not distinct war-forms, but increasingly important components in the business of war.²² The relative importance of the different components is unique to the individual nation. For instance, Japan exercises a world role overwhelmingly through its economic penetration, which has increased in the developed countries of the world. Much of the political and military potential of Japan remains dormant and most likely will continue to be dormant as long as the economic component is effective and beneficial.²³ In the broader perspective, information-based warfare is multi-dimensional. Information-based warfare is a national strategy that employs all the tools of national power to create a competitive advantage at the national strategic level. Information-based warfare is more than the application of information technology to the current instruments of war. It represents the actions necessary to paralyze the central nervous system of not only the military command and control system, but the political system or the financial system of a nation.²⁴ In this light, it requires a reevaluation of the nature of war - including a broadening of scope to include the dimensions other than military.

The information revolution has resulted in the optimization of wealth creation in the agrarian and the industrial societies. Land is made more productive; assembly lines are made more efficient and more responsive to consumer demands. The wealth creator (knowledge) for

the Third Wave society has become just as important for the First and Second Wave societies as it is for the Third Wave society. It is their link to future wealth and they will achieve it through the acquisition of information technology and the capabilities it will provide. In this sense, the information revolution brought about a shift in the balance of power. The disintegration of the Soviet Union is but one bit of evidence. The information revolution had significant impacts on the outcome of the Cold War between the United States and the Soviet Union. While not viewed as information-based warfare, the effects of the information revolution upon the Soviet Union support the assertion that the Cold War victory was the first Third Wave victory and may be an indicator of the future Third Wave war-form. Although a case can be made that considering the nature of the information revolution and global economies, Third World nations can have significant leverage against the more vulnerable Third Wave societies. The underlying forces of the information revolution are causing such a shift in the balance of economic, political, and military power. Underlying and driving the information revolution are two powerful tides that are rocking the power structures of the world. The first is the increase in and widespread dissemination of knowledge. The second is the increasing importance of knowledge in the production of wealth and the relative decline in the value of material resources. Our society and economy have undergone fundamental and unalterable infusion and mutation caused by information technology. With this transformation to Third Wave is a change in what constitutes an asset and what creates wealth. Intellectual capital is becoming more important than physical capital. The new source of wealth is not material, it is information. The pursuit of wealth necessitates a pursuit of information. ²⁵

"Those who fought for control of the future made use of violence, wealth, and knowledge." Today a similar, though far more accelerated, upheaval has started. The changes we have recently seen in business, the economy, politics, and at the global level are only the initial skirmishes of far greater struggles to come. A revolutionary new system for creating wealth cannot spread without triggering personal, political, and international conflict. Change the way wealth is made and you immediately collide with all the entrenched interests whose power arose

from the prior wealth system. Bitter conflicts erupt as each side fights for control of the future.²⁶ For the Third Wave society its greatest vulnerability, its center of gravity, is its economic information.

"At the highest levels, anti-wars involve the strategic applications of military, economic, and informational power to reduce the violence so often associated with change on the world stage. The information age is changing the relationship between the government and the citizen; between one sovereign government and another; between corporations and regulations."²⁷ The "battlefield" in the Third Wave perspective lies not in the military dimension, but in the economic dimension. Militarily, in comparison to the past, the world may today be more reasonably at peace, but economically there exists conflict between the powerful nation-states, between the haves and the have nots of the world.

Sun Tzu declared that "all warfare is deception" and that "the skillful strategist should be able to subdue the enemy's army without engaging it, to take his cities without laying siege to them, and to overthrow his State without bloodying swords". He suggested that capture of the enemy's army - not its destruction - was the goal. Attacking his strategy and disrupting his alliances were of primary importance. Clausewitz, in *On War*, stated that "knowledge must become capability". Today, the opportunity exists to transform knowledge into capability via information dominance. This capability draws from the ability to analyze opponents in terms of their key centers of gravity and vulnerabilities.²⁸ In a Third Wave civilization the economic dimension has become a major vulnerability.

Information-Based Economic Warfare

Americans now believe that there will be no more great wars between major powers. The capabilities for physical destruction for both sides are too high. The world has grown so economically and politically interdependent that in such a conflict a country would probably hurt itself as much as its adversary. The concept of national security is also changing. What was once a single external threat has now given way to security concerns that exist both inside and outside a country. The external problems that are clearly considered security threats include economic

competition.²⁹ "In this larger and more integrated sense, national security becomes increasingly inseparable from international security; in place of the narrower military concept there is emerging a larger definition that encompasses an entire spectrum of challenges. A threat to national security means anything that challenges a people's health, economic well-being, social stability, and political peace."³⁰

President Truman in a message to Congress in 1950 stated that "our power to join in a common defense of peace rests fundamentally on the productive capacity and energies of our people."³¹ Without a healthy sustained national economy, this country could not carry out the economic costs of adequate security measures over the long term future. President Nixon was fond of saying in the 1970s and 1980s that World War III had already begun and that it was an economic war. As a nation we are just now beginning to understand what the Japanese learned long ago. Our economic interests are merging with our national security. The new world order accentuates disparities in quality of life around the world. The East-West military tensions of the past have been replaced with North-South economic tensions.³²

The February 1995 version of the National Security Strategy specifies "promoting prosperity at home" as a central goal of our national security strategy. Our economic and security interests are increasingly inseparable. The strength of our diplomacy, our ability to maintain an unrivaled military all depend in part upon the strength of our economy. Our economic strategy views the private sector as the engine of economic growth, and the government's role as an advocate of U.S. business interests; leveling the playing field in international markets; taking a greater role than in the past in dealing with the global economy. Ironically, the new United States strategy also includes a liberalization of export licensing controls for computers, supercomputers and telecommunications equipment.

While military power has long appeared to be the most important indicator of a nation's power, the fact is that its economic strength is more important. The wealthiest nations could afford the largest armies. Those nations, like the Soviet Union, that could not afford the largest armies but tried anyways, failed. In some cases, like Japan, nations have economically competed

in what is a not-too-subtle form of economic warfare. Samuel P. Huntington postulates that the "Japanese strategy is a strategy of economic warfare." It is a strategy "designed not to promote Japanese economic welfare but to maximize Japanese economic power" ³³

From the end of World War II to the present day, Japan has adhered to a policy of government intervention in the country's economic growth. It has directed industry toward particular long range goals and encouraging competition. During the 1960s, Japan was inferior to the West in the development of computers. The government set out to rectify this situation by stressing the crucial importance of knowledge-intensified industries and computers in particular. As part of this program, government subsidized 50 percent of the costs of development. It also created an organization that provided Japanese producers with the means to pool this research effort and share results. "It was a planned assault on the technological high ground, carried out by the Japanese government and industry working together" ³⁴

Another component of the Japanese grand strategy has been the acquisition of knowledge through strategic alliances. The Japanese have put a considerable effort in the process of acquiring knowledge, refining it, and ultimately benefiting from it economically. The evolution of knowledge has enabled Japanese companies to catch up with the West and many times surpass them. Although Japanese contributions to the basic research and development of information technologies have been small, they have become strong players in the industry. The flow of technology has been from the United States to Japan. ³⁵

In a world in which the military resolution of conflict between major nations is becoming less likely, "economic power will be increasingly important in determining the primacy or subordination of states." ³⁶ With the end of the Cold War, alliances that gave priority to common collective security interests have been subordinated to national economic aims. As the ties of the Atlantic frayed, economic competition between these once allies intensified. The same holds true with the Japanese as the United States exerts constant pressure to end what it called Japan's unfair trading practices. ³⁷ The cold war alliances have shifted toward the three highly competitive trading blocs consisting of the United States, Europe, and Japan.

Any activity deliberately engaged in to produce a detrimental economic reaction in another nation should be called economic warfare. Such a practice is definitely warlike in character regardless of how it is labeled. The term "warfare" carries with it the connotation that implies the presence of a current threat. For a warlike action to be acted upon, it must be recognized as such.

³⁸ This concept of economic warfare is not new. In 1954, George Lincoln defined it as "...all actions other than military taken to weaken or disrupt the ability of an enemy or potential enemy to provide economic support for his national policy." ³⁹ The current Joint Chiefs of Staff (JCS) definition of economic warfare as stated in JCS Publication 1 is "aggressive use of economic means to achieve national objectives." The Dictionary of United States Military Terms, published by the Joint Chiefs of Staff, defines economic warfare as follows:

The defensive use in peacetime, as well as during war, of any means by military or civilian agencies to maintain or expand the economic potential for war of a nation and its (probable) allies, and, conversely, the offensive use of any measure in peace or war to diminish or neutralize the economic potential for war of the (likely) enemy and his accomplices.

Economic warfare can be used to achieve national objectives in varying ways. "New types of economic policies have developed by which nations now attempt to strengthen themselves and retard their rivals in times of peace and cold war." ⁴⁰ Modern objectives of economic warfare activities include: (1) to improve one's own economy; (2) to build the economic strength of one's allies; (3) to improve one's economic advantage over the enemy; and (4) to maintain the friendship of uncommitted nations. The tools of economic warfare are employed specifically to penetrate the economy of another nation. In effect, economic penetration may be considered as infiltration of a nation's industry and business enterprises for the specific purpose of exploiting or sabotaging the national economy. The goal of economic penetration is to achieve a position of influence at sensitive spots in the economy of a foreign nation. Economic penetration is more a matter of intent than method. When the intent is to weaken a potential enemy or to capture some control over a free country, it becomes a technique of economic warfare. ⁴¹

Economic warfare is alive and well in the information revolution. With over 125 million computers tying our nation together, the United States is leading the world into a globally networked society, a true information age where information and economic value become nearly synonymous.⁴² Economically speaking, not only do we build houses and offices and factories from information, we sow, fertilize, and harvest our crops with information, we move our most precious possessions on highways of information.⁴³ Modern economies require access to huge amounts of information and the computer power to manipulate it. The free flow of scientific and technological knowledge is essential to innovation and continued productivity. Millions of researchers, scientists, and citizens have access through their personal computers to more than three thousand publicly available data bases, some storing billions of bits of technical, demographic, or scientific information. These are means of penetrating the economy of a nation by siphoning off valuable technology.⁴⁴ The internet and similar networks are vast libraries of knowledge just waiting to be siphoned.

For example, the proposed imposition of United States trade sanctions against China was based on differences over the protection of what has recently been identified as "intellectual property" (Intellectual property meaning patents and copyrights). In an effort to avert trade wars between the two countries, agreements were being worked to provide for tougher Chinese enforcement measures against the piracy of copyrights, patents and trademarks.⁴⁵ Another Washington Post article on the same day describes a "high pressure campaign waged by the United States government" using CIA agents and NSA capabilities to sniff out French bribes and financing terms in an effort to ensure United States firms won a \$6 billion contract with Saudi Arabia.⁴⁶

The world's gross national product is about \$27 trillion and is held mainly by the tripolar economic powers of the United States, Europe, and Japan. This figure is dwarfed by the world's financial economy which exceeds \$1 quadrillion and includes the stock and commodity markets. As recently as 1980, the daily volume of trading in the foreign exchange market in the United States was approximately \$10 billion. Within ten years it grew to almost \$200 billion and the

United States market was but one part of the global market. Today with almost \$2 trillion changing hands on the New York stock exchange everyday, the world financial market is out of the hands of the banks and the governments of the world. ⁴⁷

The global economy is largely dependent upon the international financial system. This system was built not by economists, bankers, or finance ministers. It was built by technologists for the community and finds its continued impetus not in finance - but in the process of technical innovation itself. In today's international money market, information about the diplomatic, fiscal, and monetary policies of all nations is instantaneously transmitted to electronic screens throughout the globe. This electronic global market has produced what amounts to a giant voting machine that reflects the value the market places on a country's currency. The size and speed of the worldwide financial market doom any state central bank intervention to expensive failure. ⁴⁸ Changes in the financial system are now driven as much by the capabilities of information technology as they are by the intentions of entrepreneurial decision makers.

International trading firms have made massive investment in the technology to manage these vast amounts of informational assets. Wall Street firms have spent hundreds of billions of dollars to build trading rooms as complex as any NASA facility just to give the trader enough information to conduct business. ⁴⁹ These global communications systems characteristic of the Third Wave nations are the critical components of the economic information war. "Information warfare currently costs the United States an estimated \$100-300 billion per year, and the financial impact on our economy increases every year. About five percent of our GNP slithers through the Global Network and out of our control." ⁵⁰ As an example, in 1991 a United States automobile manufacturer estimated it lost \$500 million because a hacker broke into their networks and stole future designs that immediately ended up in the hands of their competitors. ⁵¹

Financial institutions have become prime targets in this new economic world. Disrupting these economies by attacking the financial institutions should reduce the overall power of the nation and influence the system to change. Disrupting an adversary's economy will directly affect the ability of the system to support its military forces, provide the nation's organic essentials and

infrastructure. Such disruptions could also indirectly weaken the political base of the leadership and make them more responsive to influence. Financial institutions are very fragile and interdependent. This makes them extremely susceptible to attack. As they become increasingly dependent upon communications for funds transfers and other transactions the communications centers become centers of gravity. Since paper transactions are becoming a thing of the past with most financial transactions occurring electronically, the communications centers are more critical targets. ⁵²

Non-lethal attacks against the financial institutions are more likely and more in line with the nature of Third Wave information warfare than physical attack. They are more deliberate and discriminate, and in most forms, they are also more deniable and secret, something with which the perpetrator would be concerned. The more conventional non-lethal methods include embargo, asset seizure and forfeiture, and other macro-economic interventions. Examples of such attacks by the United States include: the July 1941 United States attempt to disrupt Japan's war aims by freezing Japanese assets in the United States and enforcing an embargo against aviation fuel; the freezing of Iranian assets after the seizure of the United States embassy in Tehran in 1978; and the freeze and embargo against Iraq after the 1990 invasion of Kuwait. "Just as the United States is vulnerable to Japanese financial pressure, similarly many Third World countries are vulnerable to financial intervention by the United States. In a crisis, such leverage could be used to force concessions or to topple a regime. ⁵³

Other less conventional non-lethal attacks, but more Third-Wave like, include efforts to disrupt communications and financial transfer systems, computer databases, and similar nodes of the financial trade by electronic means. "According to the United States Congress Office of Technology Assessment (OTA), the most serious problem related to international banking is the increase risk associated with the communications networks used for electronic funds transfers. During the 1980s, many large banks set up their own private communications networks that were interconnected with the public network. Because of the requirement to be linked electronically with customers computers, the scope of internetting among corporations and customers is

increasing. The most likely and effective means to attack such systems may be to enter the microcosm using software viruses and other malevolent technologies to prosecute the attack electronically. Financial systems, with their reliance on computers and electronic data networks are particularly susceptible to such attack. ⁵⁴

"As with all things, what man invents man can counteract." If the brains of our information systems are the software, they are vulnerable to relatively cheap attacks on some of our most costly and complex economic and financial systems. Software warfare is coming of age as a new type of systematic offensive warfare, one that can be waged far removed in space and time from any battlefield to influence peacetime balances of power. Software attack is emerging in the form of viruses, Trojan horses, and logic bombs which can "strike key civilian targets, such as electronic funds transfer and other financial and data communications systems. "Unlike complex weapons systems, planting software viruses is within the financial reach of the smallest countries and, if successful, is capable of altering the balance of power in a manner similar to the way the invention of new weapons has done in the past. ⁵⁵

"When information technology made information the most important factor of production, it made the timely acquisition of the best information the number one goal of business management." ⁵⁶ Networking and embedded data systems are proliferating and computers have become such an integral part of business in developed countries that computer risks cannot be separated from general business risks. The ability to abuse computer systems is becoming widespread at a time when international corporations, financial, research, and other computer networks are growing. ⁵⁷ Single computer terminal entrepreneurs have become commonplace. Large corporations are now permitting employees to work from their homes through netting. Today more than ever, having a business strategy means having an information strategy, a strategy for recognizing opportunities, a strategy for transforming data flows into valuable products, a strategy for ensuring the company derives the full value from the knowledge accumulated by the workers, and a strategy for protecting the information. ⁵⁸

The technologies of the information revolution also offer opportunities to consider old concepts in new ways. For example, trade and economic embargoes have been traditional tool of coercion and deterrence. In the past, embargoes have concentrated on stopping the flow of tangible materials from entering a country. The success of the embargo is largely based upon the dependence of the country on the embargoed material and the ability to execute the blockade. The more dependent the country is, the greater the chances of success. The same concept applies to information. Modern societies are based on the access to information. Therefore, the ability of a country to stop the flow of information to another country can be a very effective tool in influencing that country's actions. Just like embargoes of the past, an information embargo could consist of a blockade that totally isolates a country from electronic information of all sorts from all sources or it could simply be the terminating of information that your country provides to another country. The success of the information embargo is based upon the dependence of the country on the information you are prohibiting from entering the country. However, unlike embargoes of tangible goods, the information revolution has made "information blockades" less feasible. Borders are no longer barriers to information.⁵⁹

The Realm of Possibility

The information revolution has provided a set of tools that have opened up new opportunities as well as vulnerabilities. It would appear that the essentiality of the economic interdependency that has resulted from this revolution would serve to deter the use of this new war-form. In reality, information-based economic warfare is a fact of life and has evolved from the very beginnings of the information age.

During the Cold War, the Soviet Union was "committed fanatically to the belief that with the United States there can be no *modus vivendi*, that it is desirable and necessary that the internal harmony of our society be disrupted, our traditional way of life be destroyed, the international authority of our state be broken, if Soviet power is to be secure."⁶⁰ In 1956 Khrushchev boasted "We will bury you", meaning that communism would win out economically over capitalism.⁶¹ Kennan in the "X" article supported the policy of containment which included

efforts to reduce the power and influence of the USSR to limits which no longer constitute a threat to the peace, national independence and stability of the world family of nations, and to bring about a basic change in the conduct of international relations by the government in power in Russia. ⁶²

In order to achieve these aims the United States was required to: (1) develop a level of military readiness that could be maintained as long as necessary as a deterrent to Soviet aggression, as indispensable support to our political attitude toward the USSR, as a source of encouragement to nations resisting Soviet political aggression, and as an adequate basis for immediate military commitments and for rapid mobilization should war prove unavoidable; (2) assure the internal security of the United States; (3) maximize our economic potential; (4) strengthen the orientation toward the United States of the non-Soviet nations; (5) place the maximum strain on the Soviet structure of power and particularly on the relationship between Moscow and the satellite countries; and (6) keep the U.S. public fully informed and cognizant of threats to our national security. ⁶³ In a sense each of the objectives involves a form of information-based warfare as a basis for implementation. If one considers the importance of the computer and its associated technology as a weapon of warfare, then it too must be considered a significant part of the massive arms buildup during this period.

This economic and political information-based warfare during the Cold War must be considered from two perspectives. The first involves the massive information technology growth of the Western nations that resulted from the Information Revolution and that far outstripped the growth of similar capabilities in the Eastern Bloc nations. The second deals with those aspects that ensured the closed communist society became aware of the economic and political alternatives to their way of life. In a sense, the first lead to the second. "Third Wave nations sell information and innovation, management, culture and pop culture, advanced technology, software, education, training, medical care, and financial and other services to the world." ⁶⁴ The United States and other Western nations excelled at this during their Third Wave transition. When the Soviet Union recognized the existence of a vast technology gap and the critical need for

"knowledge" it went to any extreme to obtain the capabilities. Although the extensive Soviet intelligence network focused on economic as well as military targets of opportunity, they were unable to gain ground on the technological progress being made by the West.

When Gorbachev recognized that the Soviet Union had fallen well behind in the information revolution, he attempted to correct this situation through *glasnost*. The ultimate sacrifice included the opening of the Soviet society to make available the technology and services from the West. Free enterprise opened the gates to the world's global information system and within years everyone in the Soviet Union knew what they had missed. "As economies are transformed by the Third Wave, they are compelled to surrender part of their sovereignty and to accept increasing economic and cultural intrusions from one another." ⁶⁵ This phenomenon weakened centralized government in the Soviet Union and strengthened the will of the people to have the system changed. The same will eventually be the downfall of any society that attempts to close its borders to information. "Communist regimes have always based their power in part on their ability to control what their citizens see and hear. That control was seriously eroded by technology." All politics, even within countries previously thought to be closed societies, are subject to the impacts of the information revolution. There is no way to avoid it. "Information has always been a key to political and economic power. But when information abounds and overflows in public, when an entire society is privy to what once may have been closely guarded 'secrets', political strategies based on a close holding of information no longer work." ⁶⁶

The Cold War has been replaced with a different world order with new complexities and dangers. Intense economic competition, based on technology and productivity, replaces military competition. Economies across the globe are linked more tightly by increased international economic interdependence. National and economic boundaries are blurred further by instantaneous communications and ease of technology transfers resulting from the information revolution. According to recent congressional testimony, foreign intelligence agencies have turned their attention toward commercial espionage with the same dedication they once reserved for military spying. The Central Intelligence Agency reports that "some 20 countries and

governments are involved in international activities that are detrimental to our economic interests at some level." Many European and Asian nations openly boast of the fact that their national intelligence services collect intelligence to benefit their industries at the expense of foreign competition. As an example, after switching to a relatively vulnerable satellite communications system, Caterpillar Corporation officials began noticing an uncanny number of closely underbid overseas contracts. Suspecting that their communications had been compromised, Caterpillar began encrypting their messages. ⁶⁷

Based on the successes of computer hackers during the 1980s, intelligence agencies began to integrate the computer as an instrument of espionage. International networks now provide intelligence agencies with a conduit to retrieve information relating to defense, economics, and technology. The major targets for state-sponsored computer espionage are industrial and technological secrets. For example, from 1986 to 1989, a group of West German hackers, run by the East German KGB, was able to penetrate sensitive systems at Lawrence Berkeley Laboratories by passing through several gateways. Once they were granted access to this network the computer spies gained access to some fifty military computers at the Pentagon, various defense contractors, several national laboratories and other military bases. Some of the data they accessed dealt with Army plans for nuclear, biological and chemical warfare in central Europe. The KGB codename for the operation was EQUALIZER. On the friendly side, the French have been involved in collecting data on technological developments since at least 1982. A joint action plan developed by the French Intelligence Agency directed the creation of a database for keeping track of information obtained from foreign companies. This plan included a "hot list" of firms targeted for electronic monitoring. Suspected penetrations by the French Intelligence also include the European Economic Commission, including sensitive negotiation information dealing with the General Agreement of Tariffs and Trade (GATT). ⁶⁸

"Critics point out that not every adversary in potential conflicts will be as information-dependent as technologically advanced nations. This is a legitimate observation; but it overlooks the fact that technologically advanced, information-intensive nations are more vulnerable to

information-based warfare simply because they are so information dependent." ⁶⁹ This vulnerability increases significantly because more and more of the technology is from commercially available off the shelf systems. These systems can be analyzed for potential vulnerabilities by any potential aggressor, third world or otherwise. For the technologically advanced nation, this implies that information-based warfare against a Third World country would be defensive in nature. "In the late 1980s, Bulgarian students and computer scientists began copying Western programs, cracking any copy protection schemes that stood in their way, and became increasingly skilled at programming their way around any problem." ⁷⁰

As the Tofflers' have postulated, our war-making reflects the way we make wealth. In fact, future conflict may reflect the vast differential between the economic have and have not nations of the world. "With less than five percent of the world's population, the United States stands as both an economic and military superpower, and the West in general represents a high standard of living unattainable by seventy-five percent of the global population." ⁷¹ The openness of societies and the availability of global communications systems have enabled the have-not nations to see what they are missing and they are willing to engage the West economically in a no lose confrontation. The lack of concern for the West's significant drug problem on the part of the world's drug suppliers is a prime example. For the suppliers, their actions are driven by dollars and intended to destroy the United States and other Western nations.

The main creators and controllers of technology have increasingly become large, multinational corporations with more global reach than global responsibility. Far from producing a solution to the gap between the world's haves and have-nots, the changing structure of the international business and investment may exacerbate them. That gap widens every year. After five decades of continuous global economic growth, the world heads toward the Twenty-first century with more than a billion people living in poverty. ⁷² This uneven surge in global prosperity has occurred at the same time as the emergence of large multinational companies that are increasingly less attached to the particular interests and values of their country of origin. As they compete against rival firms for world market shares, they have developed a strategy of

directing investment and production from one part of the world to another, with the help of revolutionary communications and financial technologies that have created a global marketplace for goods and services. As the global economy becomes even more integrated, these corporations will become even more important. Given a global market, competition among firms is driving them to sell and produce in all of the major economic regions of the world. The deregulation of world money markets and the information revolution have resulted in a significant global capital flow.⁷³ As in the case of business regulation, government power over information is being mitigated by the need to compete with more free, less regulated states and economies.⁷⁴

To the economic nationalists, globalization threatens to undermine the assumed integrity of the nation-state as the central organizing unit of domestic and external affairs. As nations continue to operate in this new global marketplace, governments are increasingly ceding control of their economic destiny. The real logic of the borderless world is that nobody is in control - except the managers of the multinational corporations whose responsibilities are with the shareholders who may have supplanted today's sovereigns in their role as prime movers. In 1986, when the Chernobyl nuclear disaster was revealed by photos from the French SPOT satellite, the power to use information shifted from the government to the private sector. Today, commercial satellites provide digital images having the resolution of older generation military reconnaissance satellites. Once again information was available to all.⁷⁵ This situation forced the United States to change its policy on release of previously restricted technology. This capability is now available as a service to any third world country in need of data, with few restrictions. Another example of this lies in the Persian Gulf War. The Iraqi invasion of Kuwait was based on a dispute over boundaries and physical resources. The historically controversial northern border was challenged in the interest of oil and waterways. While physical territory was occupied by tanks and soldiers, virtual Kuwaiti entities still operated. Electronic banking was available within the country and throughout the world. Kuwait was able to operate as a nation-state in spite of its being occupied by a foreign power.

Conclusions

While the major world powers have felt the effects of technological advances most keenly, the less powerful, emerging nations have also been indirectly affected by this technological struggle. "The end of the Cold War has not meant the end of conflict between smaller powers. With the unity of the West fractured by the end of the security threat, economics threatens to become, to paraphrase Clausewitz, a continuation of war by other means." ⁷⁶ Major nations are now more vulnerable to economic exploitation than ever before. A nation must be economically strong to compete in this environment. While the world has recognized the economic character of this struggle, it has not been referred to as "economic warfare" especially among the "Third Wave" nations. ⁷⁷ Recognition of this threat is a necessary first step to developing a defensive knowledge strategy.

The nation-state system is under increasingly intense pressures. World population will double by the middle of the next century and mainly in developing countries that lack the economic base and political institutions to mediate demands and conflicts. At the same time, expectations are rising, and state power over international decision making is being undermined because of the rise of global markets, the explosion of technology and information. The speed and diversity of this change is unsettling at global, national, group, and individual levels. As traditional first and second wave societies industrialize and adopt the new technologies, they displace vested interests and elites. The more advanced societies are threatened by the onset of post-industrial knowledge-based economies. The effects of these changes is to encourage transnational and supranational networks that integrate advanced societies into a complex web of interdependencies. In this changing world of "wealth weapons" and "knowledge warfare", the current war-form must go beyond the model proposed by the Tofflers. "Military strategy must be rethought in order to capture not only a change in technology but a new set of goals and even principles." ⁷⁸

In spite of the impending threat and the increased vulnerabilities associated with the information age and the global economy, the "tendency in the United States has been to let these

developments be decided by the marketplace. No philosophy has developed on how we should protect ourselves from the unscrupulous use of the new technologies for power or personal enrichment. Clearly, information is power. Control of a unified system by any government would greatly increase its potential for restricting access and therefore negating the beneficial effect of free information flow.⁷⁹ Nations and economic blocs are playing more direct and supportive roles in their industries. We must acknowledge that we are no longer in just a domestic game; competition is global. Peace will be a world of continued instabilities and surprises, including technological surprise and third world countries possessing first-world weapons. As economic interests merge with national security strategies, major industrial advances and national financial data become national economic security assets that, if lost, would negatively impact the growth of the nation, its economy, its global competitiveness, and the interests of its citizens and workers. The United States needs to recognize these threats and should adopt a policy that declares attacks against these assets as an attack against the interests of the United States. The policy should also provide the mechanism by which the nation can protect itself against aggression by information warriors.⁸⁰

"Technology is a strong measure of national power. Vital to winning wars, it is also key to winning in peace. Innovation and its productive applications have been and will be the indispensable foundation for economic competitiveness and winning the peace.⁸¹ Harnessing this technological revolution is essential to meeting national security needs. Consequently, this nation must stay on the leading edge of technology. U.S. programs must be geared to avoid technological surprise and to ensure the effectiveness of research and development.⁸² The best organization in the world cannot carry out an effective program of economic warfare unless supported by an adequate system of economic information. We must have "economic intelligence" about friendly and unfriendly countries in order to appraise the need for, and effect of, economic warfare measures and foreign economic measures. The weaknesses of aggressors and potential aggressors are the fruitful areas for economic warfare measures.⁸³ The weaknesses of ourselves and other friendlies represent those areas requiring the best defense and

most effective protective measures. The exercise of information dominance in both crisis and war is the most effective deterrent to information warfare. It will depend upon developing and maintaining capabilities and resources during peacetime. "Like seapower and airpower before it, information dominance must arise and operate continuously." ⁸⁴ In light of this, resources of the United States intelligence community should be applied to our global economic competition. Because of the open nature of the global economy, this activity would not necessarily imply industrial espionage. If properly tapped, open sources of the global network can provide our intelligence services and industry with what they need to make decisions.⁸⁵

The future information-based economic war-form we face as the Third Wave collides with the past go well beyond the corporate takeovers and restructurings seen so far. The Tofflers predict these are merely the first salvos in far larger, quite novel business battles to come. They hold that the recent upheavals seen in Eastern Europe and the Soviet Union are mere skirmishes compared with the global power struggles that lie ahead. Nor has the rivalry among the United States, Europe, and Japan reached its full intensity. ⁸⁶ The Third Wave societies characterized by the Tofflers will indeed face a new and threatening war-form in the future.

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